Building Sandcastles

Materiality, time, and space in entrepreneurship education

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THINGS THAT DO: EXPLORING THE MATERIAL AND SPATIAL DIMENSIONS OF ENTREPRENEURSHIP EDUCATION

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In this paper, we focus on a hitherto overlooked aspect of entrepreneurship education, namely the influence of materiality and spatial context on the process of teaching and learning. We present an empirical examination oriented toward the material and spatial dimensions of entrepreneurship education. Our theoretical and methodological approach builds on actor-network theory. Data was collected through participant observation and the analysis focuses on micro-level practices. Our findings demonstrate the agency of material artefacts and how they enable teachers to act at a distance by standing in as a scaffold that maintains the learning space as it interacts with the students. This acting at a distance, however, is highly uncertain and uncontrollable. Also, we recognize the importance of the infrastructure of the learning environment and argue that establishing a good, functional infrastructure reduces resistance to enabling positive learning experiences.

Introduction

The valuation of entrepreneurship in the political and societal realms has been steadily rising as part of an emerging discourse that emphasizes the role of new ventures and entrepreneurs in the economy (Audretsch & Thurik, 2001). Higher education institutions have responded to this increase in demand by identifying the education of entrepreneurs as a top priority (Volkmann, 2004). As a result, thousands of courses are offered to equip future generations with the skills and knowledge needed to fulfill this perceived demand. The expansion of entrepreneurship courses has been followed by an intensifying research interest in how and with what effects entrepreneurship education (EEd) occurs and its consequences (Carlsson et al., 2013).

In EEd, there is generally a focus on the individual learner. The emphasis is on creating entrepreneurs in the form of enterprising *individuals* (Shane & Venkataraman, 2000; Thrane, Blenker, Korsgaard, & Neergaard, Forthcoming). Accordingly, much of the attention in EEd research has been granted to a) the effectiveness of EEd activities on the entrepreneurial ability, self-efficacy, and intention of students and b) understanding how EEd activities influence the learning of students (see Blenker, Elmholdt, Frederiksen, Korsgaard, & Wagner, 2014). The focus in entrepreneurship research is thus squarely on the individual, and it emphasizes the power of the volition of teachers to teach and learners to learn. While this focus is justified and relevant, it does overshadow a number of aspects that are crucial to our understanding of how entrepreneurial learning is created and how teachers can facilitate such learning. These aspects include the context in which the learning activities take place, and particularly the spatial and material contexts in which the physical context of the teaching situation and the objects and technologies that are involved can influence the learning processes in ways that individual teachers and students do not determine or control – or, in the vocabulary of ANT, how things assemble to produce agential possibilities (Fenwick & Edwards, 2010).

In this paper, we seek to add to this overall ambition by focusing on a somewhat overlooked aspect of EEd, namely the influence of materiality and space on the process of teaching and learning entrepreneurship in a higher education setting. Our focus is not on the "what" of student learning but rather the "how," and we examine the construction process with a particular focus on the influence of the spatial and material (e.g the physical classroom and the objects and artefacts used in the classroom) contexts on learning. With a starting point in an ANT perspective of education, we suggest that the materialities of the educational context are also active in and influence the construction of knowledge and learning, sometimes in ways that are beyond the control and attention of teachers and students. These perspectives have unfolded more generally in regard to education in Sørensen (2009) and Fenwick and Edwards (2010), but are not found with a particular focus on EEd. We therefore focus on what we refer to as "learning assemblages" in EEd. A learning assemblage is the relational composite or network of human, non-human, technical, and material elements that is constructed in the processes of learning and in which the learning may be embodied, i.e. a form of infrastructure for learning (Fenwick & Edwards, 2010). The notion of the learning assemblage broadens our perspective from only seeing the teachers and students and their social and communicative relations to also including the context in which the teacher, students, and their relation is embedded. Learning is therefore not considered solely a mental operation in the mind of the learner, but also a construction process that involves technologies, artefacts, and materialities, and which relies on them to take place (Fenwick & Edwards, 2010). The importance of assuming this broader perspective is evidenced by the proliferation of

learning-assisting technologies and artefacts introduced in classrooms, and not the least in entrepreneurship classrooms, which are often littered with sticky notes, canvases, elaborate mind maps on whiteboards, and Power Point slide decks.

In addition to noting the paraphernalia of entrepreneurship classrooms, we further argue that focusing on learning assemblages is even more imperative in EEd since this activity is increasingly adopting an experiential "learning through" approach, in which the students engage in actual or simulated full or partial entrepreneurial processes (Pittaway & Cope, 2007). Learning through entrepreneurship by definition involves an externalization of the learning activities in the collaborative construction of opportunities that are not merely subjective in the minds of the entrepreneur-cum-student (Blenker et al., 2012; Rae, 2007; Thrane et al., Forthcoming).

We examine two cases, both of which are educational courses in entrepreneurship that use a teaching *through* entrepreneurship approach (Gibb, 2002; Hannon, 2005). The first is a summer school run by the research project Promoting A Culture of Entrepreneurship (PACE) and the other is a semester course offered by Aalborg University in Denmark, also on entrepreneurship. These courses are interesting as they are somewhat similar in their teaching approaches, yet they vary in key temporal and spatial dimensions and thus allow for a broader exploration of how different assemblages change the conditions for learning. Our findings suggest that approaching entrepreneurship education from an ANT perspective does disclose new avenues that warrant further exploration. The mundane interior space emerges as an significant actor that plays a vital role in structuring the learning process for the involved parties, as it is through here that information and knowledge are distributed among participants. We also learn how alliances (the relations between students, teachers, and their projects) change, which is pivotal in order for the learning-through process to happen. All in all, we find that ANT provides a new dimension that can potentially facilitate better constructions of successful learning experiences.

In the following chapter, we begin by providing a brief overview of EEd before discussing how ANT can benefit the study of this phenomenon. We then outline the methods used in the study. The findings explore three vignette examples from the study, which highlight episodes and processes that explore and address our research questions. We conclude with a discussion of our findings.

Entrepreneurship education

Entrepreneurship involves the creation of value through the introduction of new combinations of means and ends (cf. Kirzner, 1973; Schumpeter, 1934). This can be done either through the formation of new ventures or within the confines of existing firms. Also, there has recently been an emerging awareness that entrepreneurs can create multiple forms of value, not solely economic value (Austin, Stevenson, & Wei-Skillern, 2006; Dohrmann, Raith, & Siebold, 2015; Dorado, 2006; Korsgaard & Anderson, 2011; Mair & Marti, 2006; Mair, Robinson, & Hockerts, 2006). Central here, however, is that entrepreneurship is fundamentally about change incited by creative re-combinations of resources to serve new ends. Consequently, the ability to mobilize and combine resources is a vital skill for entrepreneurs (Baker & Nelson, 2005).

New combinations of means and ends are referred to as "opportunities" in entrepreneurship research, and the entrepreneurial process is conceptualized as one that creates such opportunities. Based on an ANT approach to opportunities, Korsgaard (2011) has defined opportunities as assemblages that are "enacted in conversational and material

interactions." In this sense, entrepreneurship as a process structurally resonates with fundamental insights of ANT, which also emphasize mobilization of heterogeneous actors into stable networks (Latour, 2005) that contain combinations of means and ends – resources combined to serve a purpose (Korsgaard, 2011). As noted, however, some authors have largely conceptualized the mobilization of actors socially, through a focus on social networks, while the material dimensions have been largely overlooked (Görling & Rehn, 2008; Klyver & Schøtt, 2011).

Considering the creative and enactive nature of entrepreneurship, it is not surprising that EEd research stresses experimental and experiential didactics and pedagogies (Blenker et al., 2012; Pittaway & Cope, 2007; Thrane et al., Forthcoming). Entrepreneurship educators are increasingly deploying methods of "learning through entrepreneurship" (Gibb, 2002; Hannon, 2005), which entails students learning entrepreneurship by engaging in actual or simulated full or partial entrepreneurial processes. As a consequence, the materiality of the resources, artefacts, and spaces in which these learning activities happen become of central importance. The learning space incorporates actual resources, materialized representations of them, or both, which enables and constrains the learning activities by opening (and closing) avenues for action and learning. Moreover, the learning realized in the learning activities depends on the opportunities created in the real or simulated entrepreneurial process. These opportunities reside in the relational space created and furnished in the learning process. The creation, maintenance, and durability of such learning assemblages are thus critical in EEd.

This positions the study of materiality and space in EEd as a key research topic. It also identifies EEd as a particularly useful domain in which to study the role of materiality and space in learning activities.

An ANT approach to entrepreneurship education

Learning has traditionally been associated with cognitive and mental operations that take place "inside the minds" of individualized learners (Danziger, 1997). While we do not wish to suggest that learning is unrelated to cognitive and mental operations, we do wish to note the relational nature of much that takes place in learning processes in general, and in entrepreneurship learning in particular. Actor-network theory as an approach to learning and education focuses our gaze on the relational interactions between both human and non-human actors and on how learning is enacted in the various networks in which they are entangled with one another (Fenwick & Edwards, 2010). Actor-network theory can sensitize us to the relations that are established when actors are enrolled in and associated with each other in the process that creates the learning assemblage whereby learning takes place. Consider the simple mechanism of note taking. This process, which (hopefully) enables the creation and extraction of knowledge when reading a text and preserves this knowledge for the student, is actually a rather complex relational operation that involves the human actor as well as multiple artefacts and technologies, including the book, paper for the notes, and the technology of a pen or pencil. Changes that occur to these materialities influence the learning process, such as if paper was not available and notes were relegated to the margins or – even worse – if the pen is lost, rendering this learning process impossible. Also, the preservation of the knowledge as available to the student depends on the maintenance of this learning assemblage. Thus, if the notes are lost, the learning becomes unavailable for the student, and the learning is then lost as well. Most researchers are probably familiar with the frustration of losing notes that contained useful knowledge and ideas.

In highlighting these assemblages, we do not argue that all learning resides within them and is thus externalized to the mind of the learner. Instead, we simply suggest that the construction of such assemblages is integral to learning processes, as they enable and constrain the construction of (certain forms of) knowledge, and that some learning becomes embodied in these assemblages.

Following this line of thinking, understanding learning processes in general and the entrepreneurship learning process in particular requires exploration of how learning assemblies are engineered (Law, 1986). This involves a focus on materialities in learning processes, as we need to explore the artefacts and actors involved in the learning process. The materialities of learning assemblages are human, non-human, social, and technical (Sørensen, 2009). Following our ANT approach, we emphasize the symmetry principle in which agency is not solely assigned to human actors, but instead encompasses objects in having agential potential as well (Latour, 2005). Thus, the materialities of learning assemblages directly act in the learning processes to enable and constrain certain learning activities. For example, the pen and paper enable note taking, but not necessarily verbal interaction. As a consequence, the materialities and non-human actors participate in and shape the learning processes in ways that may or may not run counter to the design and intentions of the teachers. This makes the learning process unpredictable, driven partly by the intentions and design of teachers and partly by the various ways that actors form their relations. In view of this, the concept of assemblage that is used here is not meant to suggest that once constructed, a learning assemblage persists over time without additional effort. In fact, it is quite the contrary; we wish to emphasize the dynamic nature of the construction, maintenance, and alterations of the assemblages.

Following this, our study seeks to explore the following research questions:

- How and with what effects are learning assemblages constructed in entrepreneurship education?
- How and with what effects is the spatial context of the learning processes enacted?

Methods

Actor-Network Theory is not a theory. According to Bruno Latour, since the purpose of an ANT study is to describe its field comprehensively, ANT is rather a crude method that seeks to avoid imposing any a priori assumptions about how actors should define themselves (Latour, 1999, p. 20). As our focus is on the materiality of the learning space and our curiosity is in describing learning assemblages, it is necessary to employ qualitative methods to properly engage with our field of study. In order to obtain an accurate sense of the influence of materiality and spatiality on the learning process, we use data generated through the use of participant observation to ensure accordance between theory and method. Johnstone (2008) has argued that exploring entrepreneurship through qualitative methods rather than quantitative ones could unlock novel venues of interest. Specifically, a material turn in EEd has been encouraged since the role of objects in entrepreneurship is not fully understood (Erdélyi, 2010). Through participant observation, we have gauged how students and teachers employed and engaged with tools and objects that at times influenced the process in surprising ways.

Participant observation has been developed and widely used in anthropology, where it emerged as an ethnographic field method for studying small homogeneous groups (Tedlock, 2005, p. 467). Our field of study was not entirely homogeneous, as students had a wide range of backgrounds, but we still deemed the settings to be fitting considering that everyone took part in the same course in the same place and at the same time within each separate case. While participant observation can mean "going native" viz. fully participating in the activities being studied, it is also possible to participate at other levels. In our case, two of the authors were present during the entire PACE course. We sat at attention during lectures and followed groups or persons around, chosen either at random or out of interest, as they engaged in assignments. All observations were recorded electronically and served as the source of the descriptions provided in this paper. For the other case, only one author was present. The research on the second course was in less depth, as the placement of the course over the duration of a semester made it impossible to ensure a more dedicated presence. Data generation was systematic but unstructured and was only loosely oriented toward a theme such as materiality. This was done so as not to contaminate our gaze one way or another, preferring instead to be open to whatever we would judge to be relevant at the time of the study. In writing down the descriptions, we have aspired to remain faithful to the original notes and to recount events as precisely as possible. Hopefully, the experiences recounted here are relatable to other teachers and researchers in the field and can thus provide a sense of verisimilitude through their resonance with other researchers, teachers, and practitioners.

The data analysis emphasized the micro-level interactions between teachers, students, the spatial setting, and materialities. Since such interactions are highly complex and oftentimes occur "under the radar," beyond the attention of the individuals involved, we found it expedient to focus our attention on those instances where the spatial and material dimensions became visible to us as some form of breakdown or problem occurred. This approach mirrors the zooming-in technique suggested by scholars from several organizations. As Nicolini (2009) has noted, zooming in on micro-practices is a useful way to explore the influence of materialities on practices, which subsequently may be discussed with regard to broader issues and theoretical perspectives, i.e. zooming out. Here, we zoom in on three vignette examples which demonstrate in various ways how spatial and material aspects influence the construction of learning assemblages.

The vignette examples were developed over several iterations between the three authors. As the first and third author were involved in data collection and the second author as a teacher in one of the cases, the analysis was developed through a combination of insider and outsider perspectives, thus allowing for a fusion of the theoretically driven and more objective perspective of the observers with the inside perspective of the teacher providing insights into the rationale and experiences of the teaching activities (Blenker et al., 2014).

Following the development of the vignette examples, a zooming out is performed to explore how the micro-level examples illuminate wider issues and relate to the theoretical approach of the study.

The research setting

The two courses, PACE and NVC, have a shared pedagogical aim of teaching entrepreneurship to students in graduate school. The PACE summer school is a two-week, 10-ECTS course organized as part of the PACE research project. The overall research project seeks to develop new teaching concepts for EEd, and the summer school is designed to implement

the conceptual work and study the processes and effects of the overall teaching concept and individual learning activities. The summer school is offered once per year and is not recurring, at least not in the same country. Two summer schools have been held at the moment of writing: one in Aarhus (Denmark) in 2013 and one in Helsinki (Finland) in 2014. The PACE summer school is designed to be a two-week intensive program for which students are expected to be on campus for nine hours a day to attend lectures and complete assignments and exercises. The purpose of the course is threefold: to enhance each students entrepreneurial potential, re-shape how students imaging what they can currently accomplish, and foster the development of unique business models during the course. Given the short time frame and the intensity of the course, the focus was somewhat localized in the sense that the students were working among themselves and helping each other, either within groups or between groups. The PACE summer school format enabled only some limited possibilities for engaging with outsiders. The organization of the PACE course was more elaborate than is typically the case with other courses. The teaching group was quite large and there would usually be at least two teachers present. Furthermore, because of the placement of the program in the summer time, there were ample rooms available for group work. Also, name tags and other "paraphernalia" typically associated with highly organized events such as conferences, but not regular teaching, were distributed to students.

The NVC course is part of Aalborg University's range of semester courses. For most students, this is their main scholarly focus during the semester. Because there is more time, the structure of the NVC course is not as intense as that of PACE. The students in NVC could generally expect lectures and workshops for 10 to 18 hours a week. Of course, teachers expect that time without mandatory participation would be used to work autonomously in groups on projects. This semester course is only offered in Denmark and has been available for three years with the same people planning and teaching the semester, thereby ensuring both continuity and progress. The NVC course was open for people from different disciplines as well as for international students. The course presents itself as a one where students can let their creativity run wild, with the overall aim of starting a business. Compared to PACE, the NVC course has less of a focus on personal growth and development and more emphasis on changing students' perceptions of entrepreneurship and turning their thinking outwards rather than inwards. In NVC, teachers were more active in bringing in people from the world outside of the university, often coordinating meetings between students and professional bankers, entrepreneurs, and investors. The idea was that students benefit more from having professionals critique them than from having only the teacher do so.

The two courses studied are similar in many ways, particularly in how they both incorporate a "learning through" logic (Gibb, 2002; Hannon, 2005). Accordingly, both courses seek to cultivate experiential learning opportunities for students by having them actually develop and work on entrepreneurial projects over which they have significant ownership. Furthermore, both courses employ group work as a central element in teaching, which allows students to learn from each other but can also facilitate potential group conflicts that may ultimately inhibit learning. Finally, both courses are situated in a Danish University setting and educational culture.

However, the courses differ in notable ways that can enlighten key issues that our research questions emphasize. First, the organizational setting varies in the sense that although the PACE summer school is an intense two-week course, it becomes the only learning activity of the students. Consequently, the course can essentially create a closed environment that is similar to a full traditional work day during which teachers and students can devote their work and study time entirely to the course. Conversely, the NVC is a semester-long course in which the teachers and students are constantly

engaged in other activities, and thus have to prioritize NVC among these activities. This does, however, create a longer time span for developing the learning activities. It also enables a more global outlook in terms of including outsiders in course activities. So, given our interest in the construction of relational assemblages of learning, it is clear that variations in the organizational, spatial, and temporal organization of the two courses yield different platforms and conditions for the development of learning assemblages.

Findings

In the following section, we present some vignettes from our study that demonstrate how the material and spatial dimensions can influence and intervene in the construction of learning assemblages. These vignettes represent zoomed-in micro-processes that address our overall research questions through in-depth exemplification. The first example illustrates how the relations between actors undergo change. The processes and conditions at work during a course are dynamic and require that teachers can constantly adapt to changing situations. In the case of our first vignette, we attempt to indicate how the presence of things affects the enactment and development of a learning situation in a direction that is not necessarily anticipated. The second vignette highlights the potential agency of a non-human object and how its presence permits teachers to act at a distance by standing in as a scaffold that maintains the learning space as it interacts with the students. This becomes especially apparent once the object goes missing, at which point we can observe how parts of what has been learned goes missing with it and must be re-discovered. Lastly, we offer examples from both courses that reveal how the mundane structuring and infrastructure of the learning assemblage influences the organization of learning. We theorize that establishing a good, functional infrastructure reduces resistance to enabling positive learning experiences.

The object of interest

This first vignette presents an episode that happened well into the final week of the PACE summer school. At this point, the students were settled into groups. Together, they were working on developing a prototype for the anomaly they had agreed upon as their shared area of interest. The previous week, students had engaged in exercises intended to help them identify personal disharmonies in their everyday life. Disharmonies are a theoretical construct that PACE employs to talk about something that is akin to a problem, but understood more in the context that it provides an opportunity for creating value (Spinosa, Flores, & Dreyfus, 1997; Thrane et al., Forthcoming). Disharmonies are personal, but they can be qualified as anomalies, which is an expression that signifies disharmonies that are recognized to be general for a larger group. The notions are derived from Spinosa, Flores, and Dreyfus' book *Disclosing New Worlds* (1997), which is the inspirational cornerstone of the PACE summer school project. By having students identify these disharmonies, teachers hoped to demonstrate to students that opportunities can be developed from their everyday experiences and interests. The current assignment in this episode was for students to build or design a small-scale version of their solution. Steffen, who was teaching at the course, was then acting as an advisor during the assignment to provide the groups with advice on which ideas to pursue and what they would need in order to create a physical representation of their solutions. Steffen was walking around to the different groups to provide input. At one of the groups, we witnessed how Steffen had to struggle to gain the attention of the group. Despite clearly being the most experienced person present, the students did not seem interested in listening to his contributions. The group was seated around a table, causing Steffen to be positioned

outside the group. In the middle of the table, there was a computer and tools that the group was using to develop its prototype, which was also in the center. The attention consistently returned to the artefacts, which were at this moment the manifestation of the students' ideas. These became much more interesting and relevant to students than listening to Steffen's input. While not realizing it at this point, Steffen was actually taking part in a competition between himself and the artefacts for the attention of the students – a competition he was losing at that point. Steffen had to give up and leave the students to their own devices, as they were much more interested in working with the materials in front of them. The association between the anomaly, artefacts, and students was essentially becoming stronger and more integral to the learning process than the association between student and teacher, which is traditionally considered of utmost importance for learning, as most learning processes are structured to allow the teacher to guide students. What is happening is that the assemblages that are vital for learning are being re-configured. While Steffen was surprised at first, he did not view it as an entirely bad development; it was a clear indication of the students becoming invested in the project, as they had become so attached to their creation that it called for greater attention. In this example, it was not the teacher who provided the most important impetus for the learning experiences, but rather the computers and tools on the table with which the students were engaging. It is through this engagement that the students – despite this being a simulated practice – begin to act and see themselves as entrepreneurs by working through the process on their own (Robinson, Neergaard, Tanggaard & Krueger, 2016). Despite knowing this, Steffen articulated that it was difficult to relinquish control entirely for not only personal reasons, but also because notions of power reside with the institution the teacher represents. They are willing to surrender some power, but not all of it. On the other side are the students. For them, the institutional boundaries seem less visible. Some might not want to take control of their own learning, preferring to rely on the teacher's authority and advice instead, while others (as was the case here) take it upon themselves to do more by embracing the autonomous path that their project offers. After all, the teachers are no longer experts in the same manner. They might be when it comes to theories, but for the practical matters, the projects the students work with are derived from their own everyday lives, of which they are bound to be more knowledgeable.

So, what this example illustrates is how the material presence of the students' ideas in the classroom re-configures the learning assemblage in a manner that draws more attention to itself. A teacher who is increasingly becoming an outsider in this process, whereby the group gathers to work among themselves, now has to compete for attention. This is an interesting situation that demonstrates how the presence of things cannot be ignored, as they can radically change the composition of the learning assemblage. While this example is a testament to the potential effects of the presence of things, the next vignette evidences how its absence can also have consequences for the process of learning.

Acting on a distance and the removal of objects?

In this second vignette, we go back in time to the second day of the PACE course when students were asked to fill out a table charting various personal resources and qualities possessed by each individual student. Since the first vignette demonstrated how materiality influences learning by being present, this example in contrast reveals how its absence can have consequences too. The chart that the students had been requested to complete was immensely colorful, with many intricate boxes and matrixes. This was part of an exercise called "*raising awareness of me*," and the goal was to make

tangible the possible resources (human, experiential, and material) that are immediately available to each student – an exercise in realizing which birds were already in their hands rather than having them worry about the ones on the roof. This follows the underlying philosophy of the course, wherein innovation with a basis in one's everyday life offers a better and more sustainable road to entrepreneurial opportunities than if one goes searching for the next big breakthrough in a field entirely unrelated to oneself. Examples of the categories they filled out were "*culture and tradition*," "*people and relationships*," "*skills and competences*," "*hobbies and interests*," and "*motivations*." Each of these categories was further sectioned off into sub-themes relating to each. For "culture and traditions," this included *norms, values, beliefs, and rituals*. After completing the chart, which consumed a substantial portion of the day, the students interviewed each other in groups of two about their tables. Sitting down to observe the conversation between two students, it became obvious that both had many doubts about whether they had done the exercise correctly. There was also considerable confusion about the technical aspects, such as what belonged in each sub-section and what the sections were supposed to cover. The teacher would remind the students that they should be able to "*activate and reinterpret"* what was written down during this session at a later stage. However, the students expressed their skepticism about the chart's possibly usefulness in helping them become more entrepreneurial. One student joked that she was a chemist, which meant she had no useful entrepreneurial talents. She had written down everything she did or related to, such as sports, interests, and family, but had no idea whether they would become relevant.

Since the charts were rather large prints, the students asked if it was possible to leave them at the university until it was time to use them again. In the back of the main room was a row of cupboards where students could temporarily store them. This meant that the charts were literally locked away in a cupboard and hidden from view. In the following days, the students were tasked with further exploring themselves and any disharmonies they experienced in their everyday lives. Building on the previous day's work, the students were tasked with finding their personal disclosing space – the place where they would be able to identify a unique problem. However, the charts were not brought out of the cupboard on these days except for one occasion when some students remembered that they might get be helpful. Although students were reminded about them earlier in the day, the old saying "*out of sight out of mind"* seemed to hold true at this point. Despite the continuity of the exercises, which now involved describing the where, what, who, and how of the space they chose to focus on, some students regressed to the same level of confusion they had experienced and expressed the previous day. With the charts no longer present, they could not assist students by adding structure and tangibility to the task at hand. The exercise this day was almost a repetition of the previous day's exercise. Although the charts were a confusing element when they were first introduced, they ended up as a node aiding students' understanding of the process. One can imagine that the charts, had they not been locked away, would have been a good aid for the new exercise too. The charts were physical representations of the networks each student partook in, but the representation disappeared overnight, which again left the students confused about what was expected of them.

Now, another aspect might also have been involved in creating the confusion we observed. This too is tied to the materiality. As the students were working on the charts during the assignment, they got along with it, but it was challenging for many to extract meaning from the process. They had been warned beforehand that working with themselves for the first week would not make them happy and that, at times, they might lose sight of the goal. The teacher stressed that the students would need to place their trust in the process. Understandably, working with themselves in a

way that seemed detached from entrepreneurship aggravated frustrations to the point that some students almost left the course in these first few days. So, although the charts (as tangible representations of the exercises) could lend structure and direction to the endeavor, they also created circumstances in which something could be done wrong. This is a normative aspect introduced in the process in the form of colored paper. From a student's perspective, the chart is riddled with tacit intentions that are not only working with and for them, as the teachers intend, but also against students. It is in instances such as these where the point that objects have agency (Latour, 2005, 63f) starts to make sense. The chart affects the ordering of the actors. Meaning has been folded into the words and the blank boxes that students have to fill out. It becomes an extension of the teachers' will and intentions. The students expressed in their conversations that they believed there was a right way to fill out the chart, despite teachers saying differently. Fear of getting it wrong became a very real concern. The example above highlights the relational aspect of the artefact and the accompanying activities. It is due to the inescapable interrelatedness that is at the heart of any object (be they human or non-human). The chart is an extension of the teacher, and teachers can be disappointed. While the students can fill out the chart to the best of their ability, the teachers retain the power to distinguish correct from incorrect. The students do not succeed in making the charts their own in the short span they were handling them, and it instead cultivates anxiety over completing it incorrectly, which the teacher would prefer did not happen.

Overall, we see that the chart was an active participant in the establishment of the learning activities. This emerges strongly in two ways. First, it was clear that the materiality enabled learning by allowing the teacher to act at a distance, making the students perform certain activities in a certain way without the teacher's explicit presence. The exercise was thus successful to the extent that it made the students reflect on themselves and their everyday lives, and as we progressed, several groups sprang up around problems that students recognized from their own lives. The acting at a distance, however, ensured that the teacher was not available for damage control when the chart enacted a normative pressure on the students. Due to its relatedness with the teacher and its open-ended design, it caused confusion and uncertainty among students. One of the advantages of things is the tangibility and concreteness they bring to the setting while retaining a malleability that allows them to adapt to the needs of a person. They also contain a structure that shapes the actions of a person in a certain way so that when the actions are aligned, it establishes continuity (Latour, 2013, p. 74). Second, the actor status of the material chart became visible through its later absence. Tools, such as a chart, can be misplaced, broken, stolen, or – as is the case here – hidden inside a cupboard. Having them with us provides an object through which a structure can be established, which we can then lean on for support. However, that same structure can disappear when the tools are taken away or begin to act in ways that disrupt original intentions. In the summer school, it is guaranteed that the structure that has been so laboriously constructed – the entire learning space – will end up in ruins when the school ends. Charts such as the one filled out by the students will end up as lost artefacts. For students, they contain a meaning in the situation, but for others, they would merely be a clue about what had happened. It can remind them of what was taught and the processes they went through because the chart, as an object of representation, still retains some agency in that regard – that is, if it survives.

The mundane ordering of things

This third vignette examines both courses to explore the spatial ordering of activities. The NVC course organizers stated from the beginning how they would like students to use the university and the classroom provided as a shared space where

they could all hang out, work, and exchange ideas when not attending the formal lectures for the course. Their hope was to create a lively environment in which creative forces could run amok, which is clearly an ambition in line with assumptions about how creative work environments flourish most effectively (Ensor, Cottam & Band, 2001). During the semester, this point was iterated several times, but students were not inclined to stay after lectures nor did they attend on days with no lectures. At the end of the semester, the organizers admitted that this was one aspect where they felt they had failed and would have to improve on in coming years. It is not that no changes occurred at all; the course was given a classroom at the university that would be theirs for the entire semester, which allowed them to make some changes, as is described in the following snippet from our observations: "*I came to see the student go through one of the last big exercises of the year. As I entered the classroom I easily noticed the changes that had occured. Upon entering, the room seemed much more alive with business plans created earlier as part of the course hanging on the walls with colorful notes attached, and a bean bag had come out of its corner."* The changes noticed were primarily cosmetic. While the room now looked inhabited, nothing else had really changed since then. From the outside looking in, it was not hard to see the most obvious reasons why the students did not use the classroom. It was small and narrow, making it feel crowded when all 28 students were present. The setup did not afford several groups sharing the room as a work space, as the room seemed more inviting for the format of a lecture, with a teacher standing in front of the students. The chairs were uncomfortable to sit in for long intervals, and the tables were so close together that when different groups had to present to each other and one group had to replace the previous one, it seemed almost comedic at times. People were stumbling over chairs and pulling on cables at the peril of many laptops. Additionally, there were no rooms the students could occupy when they were required to do group work. The classroom did not have the necessary capacity for all groups to sit there at the same time, so some of them would have to find available tables in the halls. These conditions resulted in the students dispersing. Instead, they met privately downtown or at other venues, thereby crushing all hope of cross-pollination between teams. It also did not help that the university is located in the outskirts of the city, removed from where most students live. It is interesting to note that the teachers were focused on orienting the students to what goes on outside of the university. "*Get out of the building,"* as one of them told the students on the very first day. Although considerable effort was actually made to inform students of events targeted at entrepreneurs that were not hosted by the university, it still seems they took the message too much to heart.

The PACE summer school, on the other hand, rapidly succeeded in structuring the space as a platform for learning. From the very first day, there was clear signposting. Nametags were at the ready and rooms available to students were clearly marked, with information about additional workspaces clearly communicated to students and teachers alike. Two large rooms adjacent to each other were available on one floor. One room was set up to facilitate lectures. The students sat in a semi-circle, which allowed teachers to move around inside the space while having points running in the background. There were no tables, however, which meant more and more students would abandon their laptops in favor of a pen and paper, or no note-taking devices at all. This seemed to create a more attentive room, as laptops were not present at all times to distract from the activity in the circle. The other half of the room, which was at the back, allowed for all the other teacher and the researchers to be present for all lessons without causing immediate distractions. This of course gave teachers the option to follow each other's teaching and follow up when teachers changed between days. The other room featured an open space that invited more active and engaging scenarios. This room was used for more extensive processes, such as the big group formation that took place the final day of the first week. This allowed for students to mingle and

view posters made by each student for his or her individual projects. The point of the exercise was that they would walk around and add ideas to each project in order to find common ground and cross-pollinating ideas, which created the basis for deciding with whom to enter into a group. Each of these rooms was immediately set up and ready to be captured so that the transition between different learning modules happened with minimal delay. In addition, there were plenty of rooms to retire to when the time called for group work, although the first days actually saw some hiccups, as there were more groups than anticipated. However, administrative personnel quickly took care of this. There was also a wide array of writing tools, notes, large paper sheets, or whiteboards available. Talk among teachers was that there had been widespread satisfaction with the venue.

Infrastructure is a term that signifies the mundane and enacted structuring of the learning space. The simple and taken-for-granted dimensions related to classrooms include internet access, name tags, power outlets, signs, chairs, and tables to use for group work as well as availability of materials, healthy indoor environments, and access to teachers and administrative personal. As described, we approach the courses as learning spaces, which are assembled spaces that need to be constructed and maintained. Learning in instances such as those focused on here does not spontaneously emerge, but is instead dependent on the cooperation of many actors. The spaces are mutable, and it is only through the work of actors that they retain a resemblance with themselves over time. As with any real life construction project, an integral part of establishing a good learning environment is to ensure the existence of helpful infrastructures (Sørensen, 2009, p. 53). The empirical data we have incorporated clearly exemplifies how infrastructures can contribute differently to the conditions of felicity with regard to the aims for each course. In the case of NVC, we saw how the articulated hope that the students would build up ideal working habits, as imagined by the teachers, failed to come true. Infrastructure is important in that it is through the roads, shared spaces, signs, and symbols that power, information, materials, and ideas move so they can be shared among participating forces in the construction process (Larkin, 2013). Meeting the conditions of felicity, or the conditions under which an experience of learning is established (not necessarily for it to be objectively measured, since conditions of felicity can vary (Latour, 2013, p. 17)) requires the homogenization of the interests of multiple actors (Law, 1986). It also relies on an elaborate coming-togetherness of things. Yet, the coming-together is not enough, as the actor that is being brought also needs order. Organization is not necessarily an intentional and planned act, as some networks afford certain alignments that enable ordering on account of the relational hybrid structure, and not through enforcement. However, some structures in the summer school are enforced so the visions and aspiration that the teachers have based on previous experiences can flourish. Among the group of teachers, there is the hope that they can shape the experience and outcome in a positive fashion, although they fully realize how they have only limited control over the process. However, as we have just seen in the previous example, materiality does have a role in shaping the process the students eventually experience. Just as with the chart, the absence of structure adds a tiny bit of chaos as the network tries to amend itself. An item like the chart becomes an embedded part of the infrastructure, and it is only through its sudden absence that a breakdown happens, which makes us aware of its function in structuring the learning (Bowker & Star, 2000, p. 35) The better the infrastructure of a given learning space, the more time can be dedicated to fulfilling the purpose described in the course description, which attracted the students in the first place.

Discussion and conclusion

As the above vignettes have illustrated, the ANT perspective can open new dimensions of EEd that extend beyond our current focus on psychological aspects. It explores the concrete practices of students and teachers as they are enacted in the courses.

In our second vignette, we saw how material artefacts are key actors in the learning process. They help teachers act at a distance, making the students perform certain activities that enhance learning. We also saw how the structure of the material table that students completed guided them firmly into performing the activities correctly, even without necessarily knowing it. It was also evident that this process of acting at a distance was fraught with uncertainty and unpredictability, partly driven by the structure of the material artefact.

The durability of the materiality and the learning assemblages also becomes evident in this example. The durability of the learning assemblages relies on its material components as much as its mental ones. The disappearance of the chart influenced the process a great deal, as some of what had already been accomplished needed to be re-discovered since the chart was a short cut to information that students did not otherwise store. This also hints at the larger issue, namely that all assemblages are perishable. They need to be sustained and maintained in order to exist. They are temporary constructs that only leave behind few artefacts, like castles in the sand that we meticulously build but which also wither as time passes. While we were not able to study it here, one hypothesis is that an entrepreneurship course that can succeed in establishing durable and strong associations between students and actors that keep them engaged in entrepreneurial practices can provide better grounds for getting new entrepreneurs into the world.

The ANT approach also complements dominant psychological concepts. In the first vignette, we saw how the externalized and materialized anomaly and opportunity became more powerful than the teacher at some points. This suggests that the construction of material learning assemblages may be a decisive component in the formation of elements such as entrepreneurial identity and self-efficacy. Thus, the ANT perspective can potentially allow us to study the emergence of these phenomena that encompass vast networks and actors that account for a person identifying as an entrepreneur or rating their self-efficacy highly.

Considering our third vignette, we note how the teachers in the NVC course saw their inability to have the students remain present and work on site was discussed as something negative that they needed to change, despite the prevalent mantra of getting the students out of the building. Significant effort was expended to attract business people with experience, many of whom were also in positions where they could pontentially have invested in or recommended a good idea; however, nothing real came from this. We cannot be sure, but it might have been that the sudden enrollment in an educational practice made it more difficult to break the boundary between there and the world where actual money flows, in a sense making it a weakness that worked counter to the aim of making students into entrepreneurs. Conversely, the same can be said about the students finding their way out of the building. If any students decided to continue working on their project after the end of the course, they would find themselves in a situation where all the structures they would have grown accustomed to would disappear. This would leave them with the additional work of finding new venues to support their entrepreneurial activity. In this sense, it might be a strength that the first step in overcoming the pre-established assemblages of structures, intended to facilitate learning, were already taken. Hereby, they already have networks outside of the university that support them.

Implications for practice

Our study has demonstrated the importance of the spatial context and materiality in the EEd setting. It is our experience that most entrepreneurship educators are already well aware of the possibilities of using artefacts and technologies in the educational setting, and consequently make extensive use of white boards, sticky notes, flip overs, Power Points, LMS systems, and so forth, just as they often pay attention to the spatial dimensions of the teaching setting and thus are attentive to the setup of the classroom, or insist on sending students "out of the building." However, we believe that our study has emphasized how the spatial organization of the teaching situation and the materialities cannot be considered passive extensions of the intentions of the teacher. So, while our findings indicate that teachers can act at a distance by using materialities, they also indicate that this is a highly uncertain process, and that much takes place in subsequent interpretations and enactments of the materialities that are beyond the control of the teacher. For some, this is a source of concern and challenges its usefulness, while for others, embracing the uncertainty and indeterminacy of translation is well aligned with the overall learning goals of EEd.

Regardless of teachers responding to our findings, we suggest that practitioners enhance their attentiveness to the spatial and material dimensions of the teaching setting, and perhaps try to employ the concept of a learning assemblage in order to sharpen attention to the kind of infrastructure they wish to set up in the teaching activity and how the spatial context materialities can strengthen certain aspects of learning by e.g. allowing the learning to be embodied in artefacts. Also, the concept of learning assemblages can be used to focus attention on the unforeseen developments that take place in the teaching process as well as how spatial aspects and materialities intervene and alter the intended processes and developments. Paying attention to not only the cognitive and communicate exchanges between individuals in the teaching setting, but also the spatial infrastructure and materialities, may prove a useful source of modifications and new ideas in the teaching process.

Implications for research

In this study, we have demonstrated through three vignette examples how spatial and material aspects become important actors in the EEd setting and comprise key elements in the learning assemblages that are constructed. While this constitutes a (hopefully) valuable first step, it leaves many issues unresolved. Our exploratory effort raises a number of interesting and noteworthy issues for future research.

Spatial and material elements take multiple forms and variations, and there are likely substantial differences in their abilities to enhance and constrain the construction of learning assemblages. Following our initial exploratory findings, it is clear that it could be worthwhile to systematically explore differences in the spatial infrastructure of EEd activities as well as the many forms of immaterialities that are used. Such studies, as with all EEd research, must take into account the fundamental heterogeneity of EEd and, accordingly, it is unlikely that they will unearth conclusive findings on the efficacy of each spatial and material element. The studies, however, may further enhance the tool sets and attention points for entrepreneurship educators and increase our understanding of how the actions of teachers and the things they use can influence the processes of learning that we are trying to enable for our students.

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